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March 8, 1921.

SPECIES OF NORTHWEST AND ATLANTIC CARANX.

John T. Nichols.

Seven species of the genus *Caranx* have long been recognized as occurring on our Atlantic seaboard and in the West Indian region. We find them properly listed in Jordan and Evermann, 1896, *Fishes of North and Middle America*, as *ruber*, *bartholomaei*, *hippos*, *crysos*, *latus*, *lugubris* and *guara*.

TECHNICAL DIFFERENCES. *Caranx guara* stands apart from the other species in that the villiform teeth on vomer and palatines, present in the young, are deciduous, absent in the adult. The teeth in the jaws, in one or two series, are subequal and blunt. The lips are thick, mouth small, lower jaw included. For the rest the soft vertical fins are low, not elevated in front, dorsal with 26, anal with 21 to 23 soft rays, the arch of the lateral line is long and low, the scutes small and rather few, 24 to 29 in number.

Superficially, at least, this species most closely resembles *ruber* and *bartholomaei*, which two are closely related. They differ from the remaining four in longer soft vertical fins, little elevated in front, dorsal 26 to 27, anal 22 to 23 soft rays. Their teeth are small and in several series. In fact, *ruber* and *bartholomaei* are a decided approach to the genus *Carangoides* which is separated from *Caranx* on the villiform teeth in its

jaws, and which does not occur in the northwestern Atlantic. The criterion used to separate *ruber* and *bartholomaei* has been depth. This holds very well for the young, which in *bartholomaei* are much deeper. Specimens under 6 inches in length (to base of caudal) have the depth contained $2\frac{1}{2}$ or less times in this length. Specimens of *ruber* down to 4 inches in length have depth contained 3 times more or less, in length, with only very slight tendency to become more slender with increasing size. The deepest individual we have measured was 2.7, and one of $13\frac{1}{2}$ inches recently examined from the Nassau, Bahamas, market was 3.2. In *bartholomaei* from 6 inches to a foot long, however, depth falls off very rapidly, and as recently noted in material in the Nassau market, there is no depth difference between the two species at the length of a foot. In smaller individuals there is generally some difference in outline, the lower jaw which is distinctly projecting in *ruber* is generally not so in *bartholomaei*, but a *bartholomaei*, $10\frac{3}{4}$ in., Nassau market, has a slightly projecting jaw, and such differences are lost in larger fish. Fortunately a reliable difference at all ages is found in the number of gill-rakers, 31 to 33 on lower limb of first arch in *ruber*, 17 to 19 in *bartholomaei*. (1).

The writer has examined ample material of *bartholomaei* down to an inch or so long. It hides about the drifting sargassum at this age. He has, however, not seen *ruber* under $3\frac{1}{2}$ inches.

The remaining four species have the front of the vertical fins considerably elevated. *Hippos* differs from the other three in having the breast scaleless except a small rhombic area before the ventrals. It also has two small canines in front of the lower jaw, but similar, though smaller canines are often present in *latus*. A fresh specimen of *latus* from the Nassau market seemed to have a similar smooth scaleless breast. This, however, was a deception due to the lie of the scales, which were present, well developed, and easily lifted with a knife-blade.

Caranx crysos is easily separated by the long straight portion of its lateral line, with many (about 50) scutes, the straight part being about twice the chord of the curve. It is a slender symmetrical fish (depth about 3, or more in length).

At present writing I am unable to give any thoroughly satisfactory criterion for separating *latus* and *lugubris*. Color

1. See *Copeia*, 1920, No. 81, p. 28, (figures for depth in first paragraph, from Jordan and Evermann, transposed, through error).

is generally used, *latus* being lightly colored, *lugubris* nearly uniform blackish. *C. lugubris*, even of large size, is deep, depth 2.4. Its profile is gibbous, the snout projecting. *C. latus* reaches large size and changes considerably with age, depth 2.5 in specimens of 5 inches, 3.5 in those over 3 feet.

RANGE. *Caranx guara* is a straggler within our limits, so satisfactorily recorded only from Bermuda, where it has been twice taken. (2) It is common along the coast of Africa, in the Madeiras and in Brazil, not rare in the Mediterranean. It has sometimes been confused with a closely related Pacific fish, *Caranx platessa*.

Caranx lugubris is found about rocky islands in the tropics throughout the Atlantic and Pacific; it occurs only as a straggler northward, if at all.

Caranx ruber and *bartholomaei* are West Indian species. *C. ruber* is probably not uncommon in Florida, but rare northward. A single small individual has been examined from Cape Lookout, N. C. (3) Young of *bartholomaei*, on the other hand, are numerous about the Capes of the Carolinas, and there are a number of records of *bartholomaei* from Woods Hole, Mass., August to November. (4) Doubtless its occurrence northward results from the habit of lurking about drifting gulf weed when young.

Both fish are well known in Cuba, but seem not to be abundant there. *C. ruber* is called "Cibi Mancho" and *bartholomaei*, "Cibi Amarillo." When I visited Cuba in 1912 these fish were considered unsafe for food and their sale in the Havana market prohibited, though some small ones of each kind were being sold there. (3) In February, 1921, coincident with two or three days of colder weather, and strong breezes from northerly quarters, *Caranx ruber* and *bartholomaei* appeared in numbers in the market at Nassau, Bahamas. They were not uniform in size, varying from say 8 inches to a little over a foot in length (to base of caudal). Very likely the larger fish of the two species have the same habits and occur together if not in the same schools. They were differentiated accurately by the natives as "Skipjack" (*ruber*) and "Yellow-jack" (*bartholomaei*), and eagerly purchased. It may be noted that C. H. Townsend, collecting fishes in the Nassau market in

2. See *Copeia*, 1919, No. 76, p. 98.

3. See Bull. Am. Mus. Nat. Hist., Notes on Cuban Fishes, 1912, p. 185.

4. Sumner and others, 1913, Biological Survey of Woods Hole, Bull. Bur. Fisheries for 1911, pt. 2, p. 752.

connection with work of the "Albatross" found the same names in use there, March-April, 1886. (5)

Caranx hippos is abundant on both coasts of tropical America, north to the Gulf of California on the Pacific Coast and to Cape Cod in summer on the Atlantic. It is also common in Cuba and found throughout the West Indies, but seems to be primarily a coastal species. Strangely enough, though the Gulf of California fish is indistinguishable from that of our Atlantic Coast, those from Brazil and tropical Africa are recognizable as a different race, *C. h. tropicus*. (6) Closely related species in the Indian and Western Pacific Oceans have been confused with *hippos*. *Caranx hippos* reaches a large size. It enters the mouths of rivers to brackish or even fresh water. It is the most generally abundant species in Florida where it is called "Jack." In Florida waters large sting rays rooting about in mud are frequently accompanied by two or three smaller Jacks (probably *C. hippos*) but for just what reason is not known. Small individuals, up to 8 inches or more, are of regular occurrence in small or moderate numbers northward on the Atlantic Coast in summer. Dates for New York and Southern New England range from July 1 (4) to October 30 (7).

Caranx latus appears to be cosmopolitan in warm seas, a widely distributed, abundant and variable species. Various nominal species which we synonymize with it have been based on age or individual characters. Some of them may be recognizable as geographic races or as varieties, but this can only be determined by careful comparison of more material than is now available. Such are *marginatus*, *rhabdotus*, *elacate* of American authors and *forsteri* of Cuvier and Valenciennes, not of Jordan and Evermann. (8) *Caranx latus* is common in Florida and occurs occasionally north to Virginia. In Cuba this species is under suspicion of being poisonous. At Nassau recently the writer found that it met with ready sale as "Horse-eye." "Horse-eye Jack" is recorded by Townsend as in use for it in the Nassau market in 1886 (5), so it has long been known there under this name. Otherwise it might have been suspected that the black fin tips, which were broken or frayed off market specimens examined there, had been remov-

5. U. S. Fish Commission Rept. for 1886 (1889), p. 670

6. See *Copeia*, 1920, No. 83, pp. 44-45.

7. Latham, *Copeia*, 1917, No. 41, p. 20.

8. 1905. Fishes of Hawaiian Islands, Bull. U. S. Fish Comm., xxiii, p. 191.

ed to conceal their identity.

Caranx crysos is found on both coasts of tropical America straying northward to San Diego in the Pacific, and being not uncommon in summer in the waters of New York and southern New England from July 1 (4) to November 4 (9). *C. caballus* of the Pacific is indistinguishable from *crysos* of the Atlantic. (10).

LIFE COLORS. The colors of the several species of *Caranx* are subject to variation with age, and adults also undergo considerable temporary color changes. But the colors of no two species are identical, and certain markings furnish reliable criteria for their determination.

An individual of *C. ruber* (Nassau market, 1921) something over a foot long was colored as follows: Top of head dark olive; otherwise silvery, greyish above and whitish below; an olive stripe along mid-line of back; below this a broad band of clear light blue; pinkish reflections along sides of belly. Iris dusky with an outer rim of pale gold and silver. Spinous dorsal pale, soft dorsal dusky grayish; upper lobe of caudal dark gray; a blackish band from peduncle slanting down along upper margin of lower caudal lobe, the lower margin of the lobe beneath it whitish; pectorals and ventrals grayish white; anal gray. The diagnostic colors of this species are the blue band along the back and black band on the lower caudal lobe. This latter is apparently a directive or identification mark in purpose and almost always present in individuals down to the smallest examined; 3 or 4 inches long. It is sometimes very obscure in worn material which has been kept in confinement of an aquarium tank.

C. bartholomaei when young is golden olive with irregular bars of silvery white along the back and belly and spots of the same on the side, and has a diffuse dusky bar through the eye. This mottled color gives it a low visibility about the drifting sargassum or gulf weed where it hides when small, and is lost as the fish grows larger and swims boldly out into wider stretches of open water. Its general color is now bluish silver, more or less suffused with olive yellow, and with rich blue, purple, and sometimes green reflections, and becomes white on the mid-line below. The top of the head is olive, and the mid-line of the back yellow, sometimes an olive yellow, and again an orange yellow. The iris is golden and the fins grayish and olive yellow. It is characterised by the olive yellow suf-

9. Latham, *Copeia*, 1918, No. 57, p. 55.

10. See *Copeia*, 1920, No. 81, p. 29.

fusion and the richness of the colors throughout.

Adult *C. hippos* is "olivaceous above; sides and below golden; a large distinct black blotch on opercle, bordered behind with pale; a large faint black spot on lower rays of pectorals, the latter sometimes wanting in young; axil of pectoral with a black blotch; edge of soft dorsal black; upper edge of caudal peduncle dusky." (11) Diagnostic markings are the brightness of the yellow lower parts, large black blotch on opercle, and especially the black spot on lower pectoral rays.

Caranx crysos varies from "greenish olive, golden yellow or silvery below; fins all pale" (11) to variously suffused with blackish. In a tank at the New York Aquarium one of perhaps nine inches in length had turned uniformly blackish in color, head, body and fins. Under ordinary circumstances this species is characterised by paleness and delicacy of colors with a conspicuous black blotch on the opercle. Of two, 7 or 8 inches in length (Nassau market, 1921), one was silvery, whitish on the belly; with delicate blue reflections mixed with lilac and bronze below; black opercular spot; iris grayish, tinged with yellow, green and rose, fins grayish, caudal with dusky tips. The other was dark olive above; sides dark gray; midline of lower parts whitish, but more or less washed with dusky; with brassy reflections above, and pink and greenish blue ones below. Iris blackish olive and olive gold. Spinous dorsal gray, dusky towards tip of lobe; other vertical fins blackish; pectoral dark gray; ventrals whitish, with a grayish area near base.

Caranx latus of about one foot length has the following colors: (Florida and Bahamas)—Dark gray above, silvery on sides, white on belly; dull greenish and slightly brassy reflections on back and sides, bluish, pinkish and greenish ones on lower parts. Iris silvery, tinged with reddish gold and with a narrow reddish inner ring. A small dusky mark at extreme upper end of gill opening; tip of scutes dusky, making a rather conspicuous dusky streak in the center of the tail region. Spinous dorsal pale; soft dorsal light gray; caudal grayish yellow; end of the dorsal lobe and margin of the caudal black. Anal gray, anterior rays, distal end of lobe and very narrow basal and marginal line whitish; pectoral pale, ventrals white. Tip of lower jaw dusky. There are sometimes an obscure dusky blotch on margin of opercle bordered in

front with brassy, and a clouded dusky blotch at the base of the pectoral below the center. These marks are less bold and different in character and position from the somewhat similarly placed ones of *hippos*. The dusky line along the tips of the scutes and small dark mark at upper end of the gill opening are diagnostic. Young are more or less distinctly banded with black.

Caranx lugubris is said to be "sooty blackish, nearly uniform, the belly not paler than back. A black spot at angle of opercle, none on pectoral. Ventrals, anal and dorsal wholly black, as are the shields of lateral line." *C. guara* is described as "bluish and silvery; no spots on fins." (11) It has a narrow black spot on the upper opercular margin.

THE ORIGIN OF THE BELIEF THAT SNAKES SWALLOW THEIR YOUNG FOR PROTECTION.

Frank G. Speck.

In America one of the most prominent English beliefs regarding animal life is the saying that the female snake is capable at times of swallowing her young to afford them protection from attack. This belief is almost universal among the English speaking people of the new world. So far as has been reported *none of the American Indians* entertain such a concept, except certain tribes whose contact with the English has been profound and among whom English folk lore has been assimilated into native oral literature. No one having thus far attempted to trace the superstition among the Latin American or the French speaking colonies of America, it is impossible to say whether or not the ethnic boundaries of the distribution of the belief are co-terminus with the extension of the speakers of English. It would be useless to try to map out the areas from which this strange, yet popular tale, has been recorded. It is safe to say that it is universal among us for it seems easier to find an individual who has never seen a live snake than to find one who has not heard of the swallowing phenomenon. This superstition having claimed some interest in the realm of folk-lore, it seems worth while to trace it as far as possible into antiquity in order to establish a starting point from which some more capable folk-lorist may carry the quest to its completion. This is the object of my paper. It would be intensely interesting from the scientific point of view to analyze the biological foundations of the belief, to probe the psychological phenomena connected with its dissemination. Where did the story originate and what may have been its path of migration?

In contemporaneous English natural history we find occasional testimony of an affirmative character. One of the most extensive discussions which I have encountered in a search for material—which however, is far from being exhaustive—M. C. Cooke, in a monograph in 1893 on British Reptiles and Batrachians, notes at length several accounts by eye witnesses whose depositions appeared in the *Zoologist* (p. 7278, p. 8856 (1863), *Science Gossip*, p. 108 and p. 160, and again in the *Zoologist* p. 2269). The author remains in a mood of laudable skepticism until all the citations have been quoted then suddenly surrenders into the semi-conviction that “there is no sound physiological reason against such an occurrence” and even includes the viviparous lizard of England within the possibility. So far as the value of bulk testimony is worth considering, the fable is one of the most heavily supported beliefs in English folk-lore. From which one might be led to infer that herpetological observation has been one of the main pursuits of dwellers in rural communities. Gilbert White in his *Natural History of Selbourne* (Letter XXXI) (1776) discusses this belief as a common one in his time and places himself on record as a careful observer who had little sympathy with its acceptance. He says, referring to a viper which he found, “When we came to cut it up we found that the abdomen was crowded with young, fifteen in number, the shortest of which measured full 7 inches, and were about the size of full-grown earth-worms. This little fry issued into the world with the true viper spirit about them, showing great alertness as soon as disengaged.” Again adverting to this lest it should be considered that he favored the popular notion that the viper swallows its young on the advent of danger, he adds, “There was little room to suppose that this brood had ever been in the open air before and that they were taken in for refuge at the mouth of the dam, when she perceived that danger was approaching, because then probably we should have found them somewhere in the neck and not in the abdomen.”

As desirable as it would be to have other literary references to snakes swallowing their young, it would be unusual if such were found in any abundance, yet we have one significant reference to it in mid-Elizabethan science. Spenser in his *Faerie Queen* (15) (Book I, Canto 3rd) describes the Serpent of Error as possessing a form, one half serpent, one half dragon, who spews out and swallows her children.

While a search thru subsequent natural history of literature in England would bring to light the volume of testimony

most of which in general is in the affirmative except for the skepticism of genial and truthful Gilbert White, we may search in vain for traces of the fable during the period antedating the fifteenth century. The superstition escaped attention by Pliny altho Aristotle (*Historia Animalium*, Book VI, XII. 566B) records a related belief, "The dolphins and the porpoise are provided with milk and suckled their young. They also take their young, when small, inside them." (1)

It might seem from this that the swallowing phenomenon was believed in by the ancient classical peoples, yet evidence for this does not seem to be forthcoming so far as I can ascertain. In the incomplete survey of old world literature which has so far been attempted in searching for the distribution of this fable, there comes an instances from Japan. There the eastern Asiatic representative of the family of pit-vipers whose local representative is the *mamushi* [*Agkistrodon blomhoffii* (Boie)] is accredited with the same performance. "The *mamushi* carries its young inside it. (It does not lay eggs). When the *mamushi* becomes pregnant two of her front teeth gradually lengthen. In order to deliver her young these teeth must be broken (so that the young will not be injured in the act). In her desire to break these teeth, the *mamushi* springs at people, biting them—this bite is very dangerous. At other times, she bites at stones or any other hard substances." (2)

It is highly probable that similar beliefs of which these are the marginal evidences may prevail or may have prevailed in the intervening regions of Europe and Central Asia. We lack, however, the actual testimony that is needed. The whole purpose of this short paper has been to provide an occasion for the announcement that like so many other ancient concepts this curious piece of folk-lore seems traceable to ancient Egypt. In following its travels thru English literature, Dr. Clarence G. Child called my attention to a reference in an old English journal (Little, Vol. 299, p. 485) evidently alluding to a similar belief expressed in Egyptian hieroglyphs. Dr. H. W.

1. This citation was provided and translated by Dr. C. H. Holtzhauser
2. Information by Mr. M. Nishiyama. The narrator adds "In olden times many people fell victims to the *mamushi* but today they know how to protect themselves. There is a place named 'Jigoku-Dani' literally it means 'Hell-Valley' where it is rumored that an abundance of the *mamushi* live awaiting their victim; whence this name"

Lutz has been so kind as to locate this interesting passage and communicates the following: This snake charm is one of the oldest pieces of verse in existence "The serpent twists; it is the serpent that twists round the leg. O, thou art on thyself. That issueth from the womb of the earth, thou hast devoured that which cometh forth from thee." It dates to the 35th dynasty (circa 2500 B. C.) (Quoted from Littell vol. 299, p. 485.)

Whatever may have been the migration of our fable, assuming its beginning to have been in ancient Egypt, it seems probable that in early times it became disseminated over much of Western Europe, finally to be brought to the new world by the English colonists, there to receive a wider distribution in the folk-lore of our continent.

Modern herpetologists generally ignore the idea or else curtly dismiss it as an improbability. John Borroughs is, however, most interesting as an exception among the modern nature writers. He, who trapped so many "nature fakers," commits himself to the following statement in Leaf and Tendiril (p. 18) "There are three things that perhaps happen near one each season that I have never yet seen—the toad casting its skin, the snake swallowing its young and the larvae of the moth and butterfly constructing their shrouds. It is a mooted question whether or not the snake does swallow its young, but if there is no other good reason for it, may they not retreat into their mother's stomach *to feed?* *Else how are they to be nourished?*" And this remarkable note, to which one might suffix several exclamation marks as an additional punctuation is to be found in the chapter entitled "The Art of Seeing Things"!

DO SNAKES SWALLOW THEIR YOUNG (1) FOR PROTECTION?

G. K. Noble

It cannot be said that modern herpetologists ignore entirely the probability that certain snakes under certain conditions may swallow their young for protection. Dr. Speck has pointed out not only in his present paper but also in an earlier one (2) the vast amount of folk-lore extant concerning the belief in such a habit. He is inclined to believe the whole mere

(1) The writer's remarks supplementing Dr. Speck's paper have been revised in the following form.

(2) Speck, F. G. 1918. Copeia, No. 57, p. 56.

fable and in this he may be correct.

Nevertheless, another instance of a snake swallowing its young for protection has been brought to my attention and as this observation has been made on a species never recorded before as swallowing its young, it may be well to detail the observation before discussing the present status of the problem. I quote directly from part of a letter from Professor Oren F. Evans of the University of Oklahoma:

"The snake was a blue racer (3) about four feet and a half or five feet long. I am very familiar with the appearance of the blue racer so I feel sure as to the kind of snake. When I came upon her, she lay stretched out at full length on a close pastured June grass sod. About thirty inches in front of her and to one side were five or six young snakes about five inches long. As I looked, the old snake opened her mouth and, I think, gave a loud hiss, but of that I would not be sure. Then the young snakes glided toward her and disappeared one after the other into her mouth. The last two went in almost side by side. After watching the snake a few moments I killed and opened her and found the young snakes in her belly. They were about eight or ten inches forward of the vent and appeared to me to be in the intestines. However, as I did not realise at the time that my investigation had any scientific value, I was not very careful in my dissection. On opening the snake, the young came out seemingly as lively as ever. I came back to the carcass two or three times during the day. The young remained alive near the dead body for some time but some of them finally died. As to whether any survived I can not say for sure. This occurred on my farm in southern Michigan.

I understand that the blue racer is an egg-laying snake. If so, the young I saw in the body could not have been unborn young.

I realize that the above is weak in several places from a scientific viewpoint, but I am giving hoping it may be worth a little.

Of course in my own mind I have little doubt that snakes do swallow their own young * * *

Some of the young snakes remained alive near the old as long as four or five hours. It was a bright, hot summer day. Also I am quite sure some of the young were injured in opening the old snake."

There have been many attempts to prove or disprove the

(3) Apparently *Coluber constrictor flaviventris* (Say). Editor.

theory that certain snakes may swallow their young to protect them against danger. Long ago a paper by Putnam (1) and later one by Goode (1) dealt with the subject in a very comprehensive way. A great many more observations were brought together by Hopley (2) and more recently by Leighton (3) and Dury (4). Some of these accounts are most circumstantial and it is difficult to understand how the observers might have been mistaken. Perhaps the most recent and one of the most detailed statements is that made by Ball (5). Goode (6) pointed out that most of the snakes stated as having the young-swallowing propensity were ovoviviparous. He listed *Thamnophis sirtalis*, *T. sauritus*, *Natrix sipedon*, *Crotalus horridus*, *Agkistrodon mokasen*, *Sistrurus catenatus*, *Heterodon contortrix*, *Elaphe obsoleta*, *Lampropeltis triangulum*, and *Vipera berus*. Most of the observations in recent years have been made on *Thamnophis sirtalis*, *Crotalus horridus* and *Vipera berus*. But Hay (7) has given additional reported observations on *Sistrurus catenatus*. Hay and later Selous, although having young ground rattlers in their terraria, were unable to confirm the observations, but the latter stated that he had seen young *Heterodon contortrix* and *Natrix sipedon* take refuge in their mother's throat. The bushmaster, *Lachesis mutus*, is stated (2) to have disgorged on two different occasions when wounded, young from its mouth.

Certain of the above incidents have been recorded by trained observers. There is no morphological reason why a

- (1) Putnam, F. W. 1869. Amer. Nat., II, p. 173.
- (1) Goode, G. Brown, 1873. Proc. Amer. Soc. Adv. Sci., pp. 176-185.
- (2). Hopley, Catherine S. 1882. Snakes: Curosities and Wonders of Serpent Life. London and New York; 1883, Journ. Sci., (3) V, pp. 365-367.
- (3). Leighton, G. 1901. The Life History of British Serpents. Their Local Distribution in the British Isles. Edinburgh and London.
- (4). Dury, C. 1910. Journ. Cincinnati Nat. Hist., XXI, pp. 68-72.
- (5). Ball, E. D. 1916 (1915). Proc. Iowa Acad. Sci., XXII, pp. 343-344.
- (6). Goode, G. Brown. Loc. cit., p. 11.
- (7). Hay, O. P. 1887. Amer. Nat., XXI, p. 217.
- (1) Selous, P. S. 1900 (for 1894-99). Rept. Mich. Acad. Sci., pp. 89-92.
- (2) Quelch, J. J. 1899. Ann. Mag. Nat. Hist., (7) III, p. 406.

young snake could not seek protection in its mother's throat. This was recognized long ago, but Leighton (3) has recently illustrated this side of the question by a photograph. Still, it must be clearly brought out that in spite of the urgent requests for "undoubted proof" made many times in the last fifty years, that proof has not been forthcoming. One asks why, if snakes do swallow their young, has this observation not been confirmed many times in the various zoological parks. Why is there not in any museum a specimen preserved with its brood of young lodged in their parent's alimentary tract. As pointed out in 1883 and again in 1901, the question of whether or not certain snakes swallow their young for protection will remain unanswered until the specimen with its young, together with suitable data, such as photographs, have been placed where they may be available to all sceptics. The American Museum of Natural History and the Editor of *Copeia* would be glad to receive at any time this valuable and apparently necessary confirmatory evidence.

NOTES ON THE MORPHOLOGY AND HABITS OF THE NURSE SHARK, *GINGLYMOSTOMA CIRRATUM*.

E. W. Gudger.

In southern Florida, where I have studied this fish for several summers, the Selachians (exclusive of the Rays) are by the inhabitants divided into two distinct classes, "Nurses" and "Sharks." The latter are reckoned somewhat, or at any rate sometimes, dangerous; the former never so. The reason for this contemptuous attitude will be apparent when the dental apparatus of this fish is described and its habits indicated.

The first known use of the term "Nurse" or "Nurse Shark" is found in Dampier. This observant navigator, in the narrative of his "First Voyage to Campeachy," (London, 1699), made in 1675, describes how the vessel on which he was serving went aground temporarily at the Alacran Reefs off the coast of Yucatan. Here there was a great abundance of fishes including "Sharks, Sword-Fishes, and Nurses; all three sorts delighting to be near sandy Bays." These must all have been young for none were longer than two and one-half or three feet. He continues, "The Nurse is just like a Shark, only its skin is rougher, and is used for making the finest Rasps."

(3) Leighton, G. 1900. *The Zoologist*, pp. 393-396, fig.

The Nurse is a short-snouted shark, broad in the shoulder parts, but tapering rapidly to a lanky tail region. The body is, for a shark, quite flat, and the large, low-placed, wide-spread pectorals add to the impression that it is a degenerate form, a shark on the way to being made over into a ray. The only flatter bodied shark is the sawfish. This structure of its body well accords with its manner of life, for it is a littoral form living in the shallows around the Florida keys and the other islands of the Caribbean-Gulf region. Other species of *Ginglymostoma* are found in the warm waters of the Pacific and Indian Oceans. All have the fifth gill slit small and partly covered by the fourth, and all have a pair of small tentacles attached to the upper lip. *G. cirratum* is dark brown in color, and under a magnifying glass the denticles of the skin appear as small, squarish, close-set tiles.

The Florida Keys are wind and wave built banks of coral sand resting on a platform of oolitic limestone covered with water to a depth of from 2 to 8 or 10 feet. These shallow banks are the home of the nurse sharks. Here they bask in the sunshine, grub around in the *Zostera* or under loose coral for their food, sleep and breed; in short, carry on their apparently aimless existence. On such a flat, on the north side of Boca Grande Cay, twenty miles west of Key West, I have, standing on the prow of a launch at a height of three feet only above the water, counted thirty-nine specimens in one herd. Constantly these sharks remind one of a herd of fat, contented pigs in an orchard where food is plentiful. They group themselves in small "pods" of three, four or five, and lie sprawled on each other, a head or tail on the body or caudal region of another, or a fin overlapping the fin or tail or body of another. Sometimes they are so piled together that, if the water is a little "roiled," one cannot see clearly where one shark leaves off and another begins.

The mouth of the nurse shark is small, in an 8-foot specimen with a gape (either vertical or horizontal) of 4 or 5 inches, and the jaws are filled with small teeth. Each tooth has a fairly broad base with a central rather long sharp cusp and two shorter ones on each side. In the specimen before me the teeth are in ranks of thirty-three, and in the upper jaw the ranks are 7 to 8 teeth deep and in the lower, 8 to 9. From this, it will be plain that the fish is surely not dangerous to man. Its food, in keeping with its tooth-structure, is mainly confined to invertebrates, squid, shrimps, the so-called "crawfish" (*Palinurus*), short spined sea-urchins, small fish, and probably the more thick-bodied and succulent algæ. In short,

the fish is more or less omnivorous.

So harmless, so sluggish and so lacking in fear are these sharks that they may rather easily be driven into shallow water and caught without harpooning. Reverting to the barnyard simile, these fish in their sluggish movements and low intelligence so much resemble pigs that there is no more sport in harpooning or hooking one than in doing so to a fat pig. My men used to drive them into shallow water, catch and drag them up on the beach, and after I had finished measuring and examining them, put them back into the water.

The nurse shark is ovoviviparous in the strict sense. The eggs, about the size of billiard balls (75mm, in diameter) break through the thin walls of the ovary into the coelom, enter the median-placed oviducal funnel, and pass on either side into the heart-shaped shell gland from which they emerge covered with heavy brownish-black horny shells having blunted ends, the homologues of the barrow-shaped egg-cases with tendrils of the rays and some other sharks. These egg-cases are 12-14 cm. long, and 17-19 cm. in circumference, and with their contents weigh about 300 grams. The semi-fluid yellow yolk lies imbedded in a whitish jelly which along the sides of the shell and especially at the ends is quite firm.

These heavy-shelled eggs pass into the posterior part of the reproductive apparatus, a saddle-bag shaped section at the hinder end of the oviduct, where they remain until the young are hatched into the uterus by the breaking of the shell. Thus we have in this fish a complicated reproductive process which seems to indicate that the ancestors of the nurse shark at one time laid shelled eggs in the water as do the Scyllids today, while our fish itself is on the way to a complete state of viviparity when the egg shell either entirely or at any rate functionally disappears.

These studies were prosecuted (and will be continued to completion) under the auspices of the Department of Marine Biology (Dr. A. G. Mayer, director), of the Carnegie Institution of Washington. When finished, the full paper will be published by the Institution.

NOTES ON LARVAL AMPHIBIA COLLECTED IN CHINA IN 1920

Harris Hawthorne Wilder (presented by Miss Louise Smith).

At Hang Chow I found as the common form of water newt, the *Triturus orientalis*, a smaller close relative of *Triturus pyrrhogaster* of Japan. As with the latter, the *orien-*

talis is usually associated with temple gardens, and with the artificially constructed water tanks about the temples themselves. Locally they are spoken of as dragons, and they are regarded with some little superstition. For instance, they are believed to belong to the temples, and that if any are taken from thence they will find some means of returning.

My specimens come from a number of little ponds along the path leading up from Lake Si-Wu to the great Buddhist temple of Ling-Ing, and at the time of collecting (May) the same ponds yielded plenty of larvae. The adults are easily seen on the bottom or rising to the surface; the larvae rest on the bottom, or among the dead leaves there, and are caught by scraping the net along the bottom, and then turning the contents out over the grass.

In a mountain brook at Moh Kan Shan, in the province of Che-Kiang I obtained a number of tadpoles characterised by a conspicuous oral hood or funnel. The brook where I found them has an elevation of perhaps 2000 feet, and is excavated deep in the sand among a tangle of bamboo and various undergrowth. These tadpoles, which in general shape are quite unlike the conventional forms, have a long and robust tail, tapering much more gradually beyond the body than is usual, follow closely the descriptions of the larvae of the Genus *Megalophrys*, of the Family *Pelobatidae*, and may well be those of *Megalophrys montana*, the common species. The hood may be put into either of two shapes or conditions, extended or relaxed. Its aperture is directed almost directly upwards (dorsally) and the true mouth and jaws are placed at its inner end. When extended the hood has the form of a narrow triangle, placed transversely across the longer axis of the animal. The animal rises to the surface, and lets the aperture attach itself to the under side of the surface film, the tension of which is sufficient to sustain the weight of the body, without further effort. There it hangs at perfect ease, perhaps for ten minutes or more at a time, and slips back and forth like a skater skating on the under, rather than the upper, surface of the thin ice, if such a thing were possible. Looking down into the interior of this funnel there is apparent a slight constant motion, as though the animal were feeding on some sort of microscopic food. When tired of this pursuit the animal lets go of the water surface, apparently by simply relaxing the hood, and drops to the bottom, where it assumes the life of other tadpoles. The relaxed lip is folded dorso-ventrally, and thus two long lateral points are formed which, curling upwards and outwards, give an appearance start-

lingly like the extraordinary moustache of the German ex-
kaiser! In an ordinary wash-bowl these Germanic tadpoles go
through their antics at intervals of a few minutes, seemingly
performing as well as in their native brook.

These actions, described by Boulenger, quoting Annandale,
but without giving the citation, have been recently again
quoted by Taylor (Philippine Amphibia, in Philippine Journal
of Science, March, 1920) as follows “* * * tadpoles are found
in mountain streams with gravelly beds and are remarkable
for the funnel-like float formed by the lips, which are beset
with minute horny teeth; these are not connected in any way
with definite ridges or lamellae, but radiate along the anterior
surface of the funnel. According to Annandale, the funnel-
shaped lip is capable of assuming two very distinct forms,
according to the position of the tadpole:—(1) When the ani-
mal is hanging from the surface-film, as it frequently does
this structure becomes a translucent rhomboidal or lozenge
shaped float, depressed in the center towards the mouth, but
otherwise nearly flat; (2) when, on the other hand, the animal
is resting on the bottom, the float takes on the appearance of
a pair of slender processes, continued upwards on the sides,
like a pair of horns.”

E. H. Taylor, from whom the above quotation is taken,
gives two species of *Megalophrys*, aside from *montana*, both
new, and speaks of the tadpole of one of them, but does not
speak of any such apparatus as this oral funnel. Also at Moh-Kan-Shan, on the mountain-side, perhaps 600—800
feet below the top, there was a little pool or spring by the
roadside; it was not more than six feet across, and a foot and
a half deep. The first of July this pool was full of small dark
colored tadpoles, each one characterized by a conspicuous
round white spot on the nose. At first they had no limbs, but
the metamorphosis began to appear, and by the time I left
the place, about the first of August, it was nearly completed.
Thus, by repeated visits to the pool I eventually got almost the
whole story. Gradually, as the separate toes developed, pads
appeared and developed on their ends, until it became evident
that I had here some species of Polypedates (*Rhacophorus*)’
and in all likelihood the common local species, *Polypedates*
mystax. It will be remembered that this Genus is character-
istic of the Oriental region, and to it belong some with such ex-
aggerated webs to both hands and feet, that they are able to
spread them fully out, and volplane downwards from the
branches of trees, veritable “flying frogs.” A large species of
this Genus, *Polypedates denysi*, with a body length of 11 centi-

meters, and a total length (body and legs) of 23, occurs in the province of FuKien, and is commonly considered a genuine "tree-frog" (*Hyla*). In reality the Genus is one of the *Randia*e, close to the typical *Rana*.

SOME REMARKS ON A NEW METHOD IN THE STUDY OF BONE AND CARTILAGE AS APPLIED TO HERPETOLOGY.

G. K. Noble. (No abstract.)

SOME OBSERVATIONS ON LOCAL AMPHIBIANS AND REPTILES.

J. Fletcher Street. (No abstract.)

THE FISHES OF BUCKS COUNTY, PENNSYLVANIA.

Henry W. Fowler.

During the past few years the writer had opportunity to visit all the larger watercourses in the county limits. Extensive observations and collections made in 1917 and 1919, largely form the basis of this note. For assistance in this connection acknowledgement is due to Messrs. W. I. and E. S. Mattern, W. T. Innes, H. E. Thompson, R. B. Farley and H. H. Burton. Localities scored with the asterisk were kindly given by Mr. George MacReynolds of Doylestown.

Petromyzon marinus—Delaware R. (Dunk's Ferry, Biles I., Point Pleasant*, Lumberville*), Scott's Neshaminy and Mill Creeks, Cold Spring Run, Tullytown Creek (Tullytown).

Acipenser sturio—Delaware R. (Murray's fishery; one of 25 lbs. and another of 125 lbs. at Tullytown in 1917; one active in the rapids at lower Black Eddy, just below Point Pleasant, about 9 feet long*).

A. brevirostrum—Recorded from the Delaware at Dunk's Ferry and Bristol.

Lepisosteus osseus—Recorded from the Delaware near Bristol.

Dorosoma cepedianum—Delaware R., Neshaminy and Mill Creeks.

Pomolobus mediocris—Recorded from the Delaware at Tullytown.

P. pseudoharengus—Delaware R. (Murray's fishery, Dunk's Ferry, Tullytown, Bread and Milk I., Biles I.),

Neshaminy, Mill, Tullytown and Scott's Creeks.

P. aestivalis—Delaware R. (Dunk's Ferry, Badger I., Tullytown).

Alosa sapidissima—Delaware R. (154 in one day at Tullytown in 1917; New Hope*, Lumberville*, Point Pleasant*, Kintnersville*, Smittown*), Neshaminy Creek.

Brevoortia tyrannus—Reported in the Delaware far as Dunk's Ferry.

Salmo salar—One in the Delaware at New Hope, about 1890, weighed 8 lbs*.

S. irideus—Introduced in Haycock Creek*.

S. fario—Introduced in Pine Run near Doylestown*.

Salvelinus fontinalis—Durham Creek and two small tributary creeks in Springfield Township*; Ely Run and Ingham Spring pond, Beaver Run, Hart Run and Trout Run near Bennett's Corner (introduced)*.

Osmerus mordax—Reported from the Delaware at Bristol.

Ameiurus catus—Delaware R. (Point Pleasant and Hendrick's I. below Lumberville*): Neshaminy and Mill Creeks.

A. nebulosus—Delaware R. (Andalusia, Dunk's Ferry, Eddington, Tullytown), Tottam Creek, Neshaminy Creek (Newtown Creek, Rushland, Pine Creek near Wycombe, N. Branch near Chalfont*, W. Branch above Chalfont*, Pine Run near Doylestown*, New Britain*, Bridgepoint*, Bridge Valley*), Mill Creek (David's Well, Queen Anne and Guinea Creeks), Tullytown Creek (Common Creek), Scott's Creek, Tohickon Creek (Randt's dam near Pipersville* and Quakertown), Perkiomen Creek (Swamp Creek).

Schilbeodes gyrinus—Delaware R., Neshaminy, Mill, Tullytown and Scott's Creeks.

S. insignis—Neshaminy Creek (Chalfont*, Deep Ford*, Castle Valley*, Little Neshaminy Creek), Paunauccussing Creek (Carversville*), Tohickon Creek (Ottsville, Beaver and Haycock Creeks), tributary of the Delaware below Tinicum Creek*, Tinicum Creek*.

Hybognathus nuchalis regius—Delaware R. (Andalusia and Dunk's Ferry), Neshaminy, Mill and Knowles Creeks.

Pimephales notatus—Taylorsville, Tinicum and Perkiomen (Pleasant Spring Creek and Perkasio) Creeks.

Semotilus bullaris—Delaware R. (Kintnersville*, Lumberville*); Poquessing Creek; Neshaminy Creek (North Branch below junction of Pine Run*, New Britain*, Prospect Hill*, Newtown Creek), Mill Creek (Queen Anne Creek), Tullytown Brook, Tullytown Creek (Fallsington), Taylorsville Creek, canal at Point Pleasant*.

S. atromaculatus—Delaware R., Poquessing Creek (Andalusia), Tottam Creek, Neshaminy Creek (Rushland and Chub Run), Mill Creek (Queen Anne Creek), Tullytown Creek (Fallsington), Taylorsville, Knowles, Jericho and Pidcock Creeks, Tohickon Creek (Beaver and Haycock Creeks), Durham Creek.

Abramis crysoleucas—Delaware R. (Dunk's Ferry, Bread and Milk I., Biles I., Lumberville), Poquessing Creek (Newtown, Little Neshaminy, Rushland, Neshaminy, Pine Run, Neshaminy Creek at Doylestown*, Weever's ice-pond*), Mill Creek (Queen Anne and Guinea Creeks), Tullytown Brook and Creek (Common Creek), Scott's, Penn's Manor, Brock, Jericho and Pidcock Creeks, Tohickon Creek (Ottsville and Quakertown), Perkiomen Creek (Pleasant Spring Creek, Trumbaursville, Finland, Quakertown and Morgan Creek).

Notropis bifrenatus—Delaware R. (Dunk's Ferry), Poquessing Creek, Neshaminy Creek (Newtown and Pine Creeks, Rushland), Mill Creek (Queen Anne and Guinea Creeks, Pigeon Swamp Run), Tullytown Brook and Creek (Fallsington), Scott's, Brock, Taylorsville, Knowles and Pidcock Creeks, Tohickon Creek (Ottsville), Perkiomen Creek (Pleasant Spring Creek and Perkasio).

N. procne—Delaware R., Neshaminy Creek (Newtown and Pine Creeks), Perkiomen Creek (Pleasant Spring Creek and Perkasio).

N. hudsonius amarus—Delaware R. (Dunk's Ferry), Poquessing Creek (Andalusia), Neshaminy Creek (Rushland), Mill Creek (Guinea Creek), Jericho, Pidcock and Durham Creeks.

N. whipplii analostanus—Delaware R. (tributary from canal to river at Point Pleasant*), Poquessing Creek (Andalusia), Neshaminy Creek, (Newtown, Little Neshaminy and Pine Creeks, Rushland, Pine Run and Neshaminy Creek near Chalfont*), Mill Creek (Guinea and Queen Anne Creeks), Tullytown Brook and Creek, Scott's, Brock, Taylorsville, Knowles, Jericho and Pidcock Creeks, Tohickon Creek (Beaver and Haycock, Creeks, Ottsville, Deep Run at Pipersville*), Cuttallosa and Durham Creeks, Perkiomen Creek (Mill and Pleasant Spring Creeks, Perkasio, Swamp Creek, Trumbaursville, Finland).

N. cornutus—Poquessing and Tottam Creeks, Neshaminy Creek, (below Chalfont*, Pine Run*, Mill Creek at Doylestown*, Little Neshaminy, Newtown and Pine Creeks, Rushland), Mill Creek (Guinea and Queen Anne Creeks), Tullytown, Brock, Taylorsville, Knowles, Jericho and Pidcock

Creeks, Tohickon Creek (Beaver and Haycock Creeks), Cuttallosa and Durham Creeks, Perkiomen Creek (Mill and Pleasant Spring Creeks, Perkasio, Swamp Creek, Trumbaursville, Finland).

N. chalybaeus—Delaware R., Neshaminy Creek (Newtown and Little Neshaminy Creeks), Mill Creek (Guinea and Queen Anne Creeks), Tohickon Creek (Quakertown), Perkiomen Creek (Swamp Creek near Quakertown, Morgan Creek).

N. photogenis amoenus—Neshaminy Creek, Mill Creek (Queen Anne and Guinea Creeks), Tohickon Creek, Perkiomen Creek (Perkasie).

Rhinichthys cataractae—Pidcock, Tohickon (Haycock Creek) and Durham Creeks.

R. atronasus—Poquessing and Tottam Creeks; Neshaminy Creek (Newtown, Little Neshaminy and Pine Creeks, Rushland, Mill Creek at Doylestown*, tributary of Neshaminy at Chalfont*), Mill Creek (Queen Anne and Guinea Creeks), Tullytown, Brock, Taylorsville, Knowles, Jericho and Pidcock Creeks, Rabbit Run, Tohickon Creek (Beaver and Haycock Creeks, overflow of canal at Point Pleasant*), Cuttallosa and Durham Creeks, Perkiomen Creek (Mill Creek and Pleasant Spring Creek).

Exoglossum maxillingua—Recorded from the Delaware at Morrisville.

Cyprinus carpio—Delaware R. (golden example of 16 lbs. in 1903 at Point Pleasant*; Tullytown, many 30 lbs.), Neshaminy Creek (Ewer's dam,* Deep Ford,* Blackman's Rocks*), Mill and Tullytown Creeks.

Carassius auratus—Neshaminy and Mill Creeks.

Catostomus commersonnii—Delaware R. (Dunk's Ferry and Tullytown), Poquessing Creek, Neshaminy Creek (Mill Creek at Flushing, Core Creek, Little Neshaminy Creek, Chalfont, Rushland, George School, Pine Run at Dyerstown,* New Britain,* Ewer's dam,* Mill Creek at Doylestown,* Pine Creek), Mill Creek (Guinea and Queen Anne Creeks), Tullytown, Scott's, Brock, Taylorsville, Knowles, Jericho and Pidcock Creeks, Rabbit Run, Cuttallosa Creek, Tohickon Creek, (Haycock Creek, Ottsville, Point Pleasant*, Quakertown); Paunauccussing Creek*, Kintnersville Creek*, Perkiomen Creek (Mill Creek).

Erimyzon sucetta oblongus—Delaware R., Neshaminy Creek (Newtown and Pine Creeks, Pine Run at Chalfont,* Bart's Pond*), Mill Creek (Guinea and Queen Anne Creeks), Tullytown Brook and Creek (Fallsington), Brock Creek, Tohickon Creek (one caught by water snake at Randt's dam*),

Perkiomen Creek (Mill, Pleasant Spring and Swamp Creeks).

Anguilla rostrata—Delaware R. (Andalusia, Dunk's Ferry, Eddington, Tullytown), Tottam Creek; Neshaminy Creek (Mill Creek, Neshaminy Falls, Rushland, East Branch,* West Branch,* Pine Run near Chalfont,* Godshalk's dam near New Britain,* Edison,* Bridge Valley,* Ewer's dam,* Ryan's dam,* Castle Valley,* Cooke's Run at New Britain,* Pine Run at New Britain* and Dyerstown,* Mill Creek at Doylestown,* Turk's dam*), Mill Creek (Queen Anne and Guinea Creeks, Tullytown Brook and Creek (Common Creek and Fallsington), Scott's Creek, Lumberton,* Cuttallosa Creek (Lumberville*), Tohickon Creek (Point Pleasant,* Myers' dam near Pipersville*, Randt's dam*, Stover's dam*, Haycock Creek), Kintnersville.*

Esox americanus—Delaware R.; Neshaminy Creek (George School, Pine Run at Doylestown,* below Chalfont*), Mill Creek, Tullytown Brook and Creek (Common Creek), Scott's, Brook and Knowles Creeks, Tohickon Creek (Quakertown and Deep Run near Pipersville*), Cuttalliosa Creek, Perkiomen Creek (Swamp Creek, Trumbaursville, Rich Valley Creek near Taylorsport, Quakertown).

E. tridecemlineatus—Mill Creek at Bristol, Common Creek at Fallsington, Pidcock Creek.

Umbra pygmaea—Neshaminy Creek, Mill Creek (Queen Anne and Guinea Creeks, Pigeon Swamp Run), Tullytown Creek (Fallsington) and Brook, Scott's Creek.

Fundulus heteroclitus macrolepidotus—Delaware R., Poquessing, Neshaminy, Tullytown and Scott's Creeks, Tullytown Brook.

F. diaphanus—Delaware R.; Neshaminy Creek (Pine and Newtown Creeks, Rushland, Little Neshaminy Creek, Pine Run near Doylestown,* Cooke's Run,* near New Britain,* West and North Branches near Chalfont*, Edison*, Mill Creek at Doylestown*), Mill Creek (Guinea and Queen Anne Creeks), Tullytown Brook and Creek, Scott's, Penn's Manor, Taylorsville, Knowles, Jericho and Pidcock Creeks, Tohickon Creek (Point Pleasant*, Beaver and Haycock Creeks), Cuttalliosa and Durham Creeks, Perkiomen Creek (Mill and Pleasant Spring Creeks, Perkasio, Trumbaursville, Finland).

Strongylura marina—Delaware R. and Neshaminy Creek tidal.

Apeltes quadracus—Delaware R., Mill, Tullytown, Scott's and Penn's Manor Creeks.

Aphredoderus sayanus—Mill Creek (Pigeon Swamp Run and Guinea Creek), Tullytown Creek (Fallsington), Scott's

Creek.

Pomoxis sparoides—Delaware R. (below Lumberton,* Lower Black Eddy,* below Point Pleasant*), Tohickon Creek (Randt's Mill* and Meyer's dam*).

Enneacanthus gloriosus—Delaware R., Mill Creek (Queen Anne and Guinea Creeks), Tullytown Brook and Creek (Fallsington), Scott's Creek, Tohickon Creek (Quakertown).

Mesogonistius chaetodon—First obtained in Mill Creek at Bristol in 1860, and since noted 1906-1908 and 1917-1918.

Lepomis auritus—Delaware R. (Tullytown, Lumberville, Kintnersville*), Neshaminy Creek (George School, Little Neshaminy Creek, Rushland, Pine Run at Chalfont,* New Britain,* Dyertown,* Neshaminy at Chalfont,* New Britain,* Edison*, Ryan's dam*, Ewer's dam*, Dark Hollow*, Newtown and Pine Creeks), Mill Creek (Guinea and Queen Anne Creeks), Tullytown Brook and Creek (Common Creek), Scott's, Penn's Manor, Brock, Taylorsville, Knowles, Jericho and Pidcock Creeks, Tohickon Creek (Beaver and Haycock Creeks, Stover's dam near Point Pleasant,* Boileau's Rocks,* Meyers' dam,* Randt's dam,* Tohickon Park,* Quakertown, Ottsville), Perkiomen Creek (Mill Creek, Perkasio, Pleasant Spring Creek, Quakertown).

L. incisor—Delaware R.

Pomotis gibbosus—Delaware R. (Tullytown), Poquessing Creek, Neshaminy Creek (Chalfont,* Newtown Creek, George School, Little Neshaminy Creek, Rushland), Mill Creek (Guinea and Queen Anne Creeks), Tullytown Brook and Creek, Scott's, Penn's Manor and Pidcock Creeks, Tohickon Creek (Quakertown and Point Pleasant*), Durham Creek, Perkiomen Creek (Mill and Pleasant Spring Creeks, Perkasio, Swamp Creek, Trumbaursville, Finland).

Micropterus dolomieu—Neshaminy Creek (Ewer's dam,* Deep Ford,* Godshalk's dam formerly,* Little Neshaminy Creek, Rushland), Mill and Tullytown Creeks, Ingham Spring pond,* Tohickon Creek,* (Quakertown,* Point Pleasant*), Tinicum Creek,* Perkiomen Creek, (Mill Creek).

M. salmoides—Neshaminy, Scott's and Tohickon Creeks (Ottsville).

Stizostedion vitreum—Delaware R. (several at Tullytown in 1917).

Perca flavescens—Delaware R. (Lumberville*), Neshaminy Creek (Newtown Creek, Rushland,* Turk dam at Doylestown*), Mill Creek (Guinea Creek), Tullytown and Scott's Creeks, Tohickon Creek (Quakertown and Point Pleasant*).

Boleosoma nigrum olmstedii—Delaware R. (Lumberville),

Poquessing and Tottam Creeks; Neshaminy Creek (Newtown Creek, Pine Run at Chalfont,* Neshaminy at New Britain* and Chalfont,* Cooke's Run at New Britain,* Pine and Little Neshaminy Creeks, Rushland), Mill Creek (Guinea and Queen Anne Creeks), Tullytown Brook and Creek (Fallsington), Brock, Taylorsville, Knowles, Jericho and Pidcock Creeks, Cuttallosa Creek, Tohickon Creek (Beaver and Haycock Creeks), Durham Creek, Perkiomen Creek (Pleasant Spring Creek and Perkasio).

Boleichthys fusiformis—Mill Creek near Bristol.

Roccus lineatus—Delaware R. (Andalusia, Dunk's Ferry, Lumberville,* Point Pleasant* and mouth of Tohickon Creek*).

Morone americana—Delaware R. (Torresdale,* Tullytown, Morrisville, New Hope,* Lumberville,* Point Pleasant*), Neshaminy and Scott's Creeks.

Achirus fasciatus—Delaware R. (Dunk's Ferry and Tullytown).

The following names were presented for membership:

(1) March, Douglas, D. H. 506 Woodland Terrace, West Philadelphia, Penn.

(2) Webster, Robert Milton. 1718 N. 18th Street, Philadelphia, Penn.

On motion, it was approved that the abstract of the meeting be published in Copeia.

On motion, it was agreed that the next meeting of the Society be held in conjunction with the American Ornithologists Union.

The business session then adjourned.

G. K. NOBLE, Acting Secretary.